EMERGING DISEASES, ZOONOSES AND VACCINES TO CONTROL THEM

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EMERGING INFECTIONS AND ZOONOSES

- EMERGING INFECTIONS: A COLLECTIVE NAME FOR INFECTIOUS DISEASES THAT HAVE BEEN IDENTIFIED AND TAXONOMICALLY CLASSIFIED RECENTLY; IN HUMANS, IN THE FINAL QUARTER OF THE TWENTIETH CENTURY, MORE THAN 30 SUCH CONDITIONS WERE RECOGNISED
- SEVENTY TO SEVENTY FIVE % OF NEW EMERGING INFECTIONS IN HUMANS ARE ZOONOTIC (WILDLIFE)

ZOONOSES

A LARGE NUMBER OF HUMAN PATHOGENS (61% OF THE 1,415 IDENTIFIED HUMAN PATHOGENS BELONGING TO 313 DIFFERENT GENERA) ARE ZOONOTIC AND

INFECT MULTIPLE ANIMAL SPECIES

BIODIVERSITY

- VIRUSES: ROUGHLY 5,000 KNOWN SPECIES; ESTIMATED NUMBER OF SPECIES: 130,000; PERCENTAGE OF KNOWN SPECIES: 4%
- BACTERIA: ROUGHLY 4,700 KNOWN SPECIES; ESTIMATED NUMBER OF SPECIES: 40,000; PERCENTAGE OF KNOWN SPECIES: 12%
- MAMMALS: 5,416 KNOWN SPECIES; ESTIMATED NUMBER OF SPECIES: 5,500; PERCENTAGE OF KNOWN SPECIES: 99%

MAMMAL SPECIES

- THE INVENTORY OF MAMMAL SPECIES IN 1982 CONTAINED 4,170 SPECIES; THE INVENTORY IN 1993 CONTAINED 4,629 SPECIES, AS COMPARED TO 5,416 IN 2005
- MOST OF THE INCREASE IN NUMBER IS DUE TO TAXONOMIC (GENOTYPIC) REVISION, BUT A SIGNIFICANT PROPORTION IS DUE TO NEWLY DESCRIBED SPECIES

ORDER CHIROPTERA

- AMONG MAMMAL SPECIES, THERE ARE 1,116 BAT SPECIES BELONGING TO 202 GENERA; 49 NEW SPECIES HAVE BEEN RECOGNISED SINCE 1993
- THAT IS TO SAY, 20.6% OF THE TOTAL NUMBER OF MAMMAL SPECIES

ORDER RODENTIA

- AMONG MAMMAL SPECIES, THERE ARE 2,277 RODENT SPECIES BELONGING TO 481 GENERA; 128 NEW SPECIES HAVE BEEN RECOGNISED SINCE 1993
- THAT IS TO SAY, 42% OF THE TOTAL NUMBER OF MAMMAL SPECIES

WILD MAMMAL BIODIVERSITY

THE HOTSPOTS OF MAMMAL BIODIVERSITY ARE OBSERVED IN TROPICAL AREAS, SUCH AS SUB-SAHARAN AFRICA, INDONESIA AND SOUTH AMERICA


Savane africaine

BIODIVERSITY OF DOMESTIC MAMMALS

- THERE ARE MORE THAN 300 RECOGNISED DOG BREEDS WITH DIFFERENT GENETIC BACKGROUNDS

- THERE ARE APPROXIMATELY 700 CATTLE BREEDS THROUGHOUT THE WORLD, MANY OF WHICH ARE AT A CRITICAL STAGE (LESS THAN 100 BREEDING COWS; GENETIC DIVERSITY EROSION)

- DOMESTIC BREEDS DIFFER IN THEIR SUSCEPTIBILITY TO INFECTIONS AND THEIR IMMUNE RESPONSE AFTER INFECTION

MECHANISMS OF EMERGENCE MAMMALS AND VIRUSES

- VIRUS MUTATION (CANINE PARVOVIRUS INFECTION)
- OPENING THE ECOSYSTEMS
  - CLIMATIC CHANGES
  - INVASIVE SPECIES
- INTRODUCTION OF NEW SPECIES (INTENDED OR ACCIDENTAL; MONKEYPOX IN USA)
- BIOLOGICAL PRODUCTS

THE FIVE Ts

- TRANSPORT
- TRADE
- TOURISM
- TRAVEL
- TERRORISM

WHY SHOULD WE DEVELOP VETERINARY VACCINES?

- To protect animal health
- To improve animal welfare
- To protect public health
- To protect consumers of products derived from food- producing animals
- To protect the environment and biodiversity
- To avoid methane emission
- To promote sustainable agriculture and animal production
- To avoid the emergence of pathogens resistant to available drugs

OBSTACLES TO VETERINARY VACCINE DEVELOPMENT

- Products specific for one condition, often in a single species
- Scientific obstacles (e.g. African swine fever, many anti-parasitic vaccines)
- Poor investment return for the companies involved in vaccine development and production
- The existence of so-called (minor) target species
- The existence of conditions of minor importance in so-called (major) species
- The existence of conditions of minor importance in so-called (minor) species (the worst-case scenario)
- Lack of uniformity in the geographic distribution of food-producing animals
- The existence of vaccination bans due to animal health regulations
- Regulatory requirements for vaccine registration

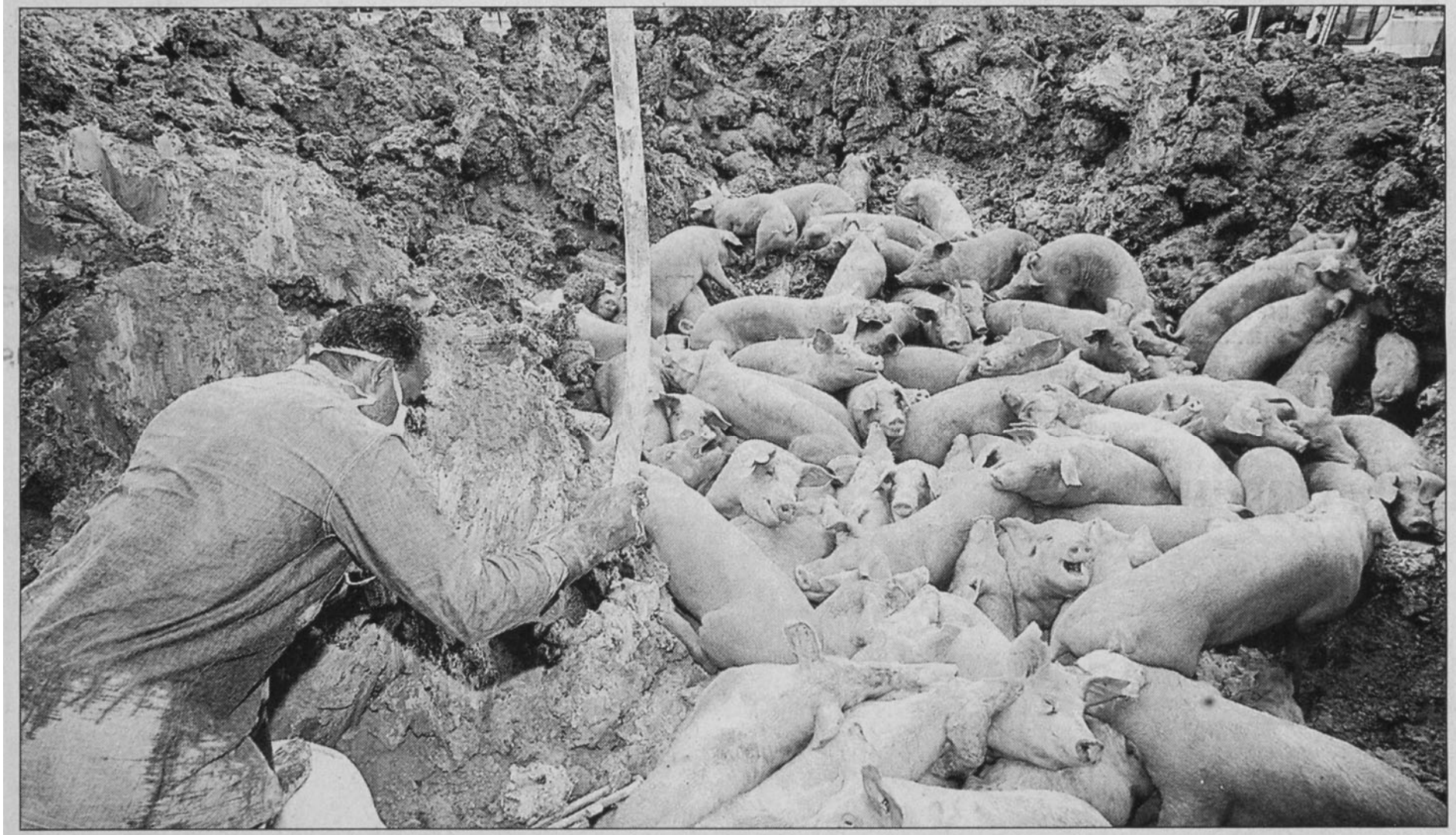
Hosts of African swine fever

Warthog

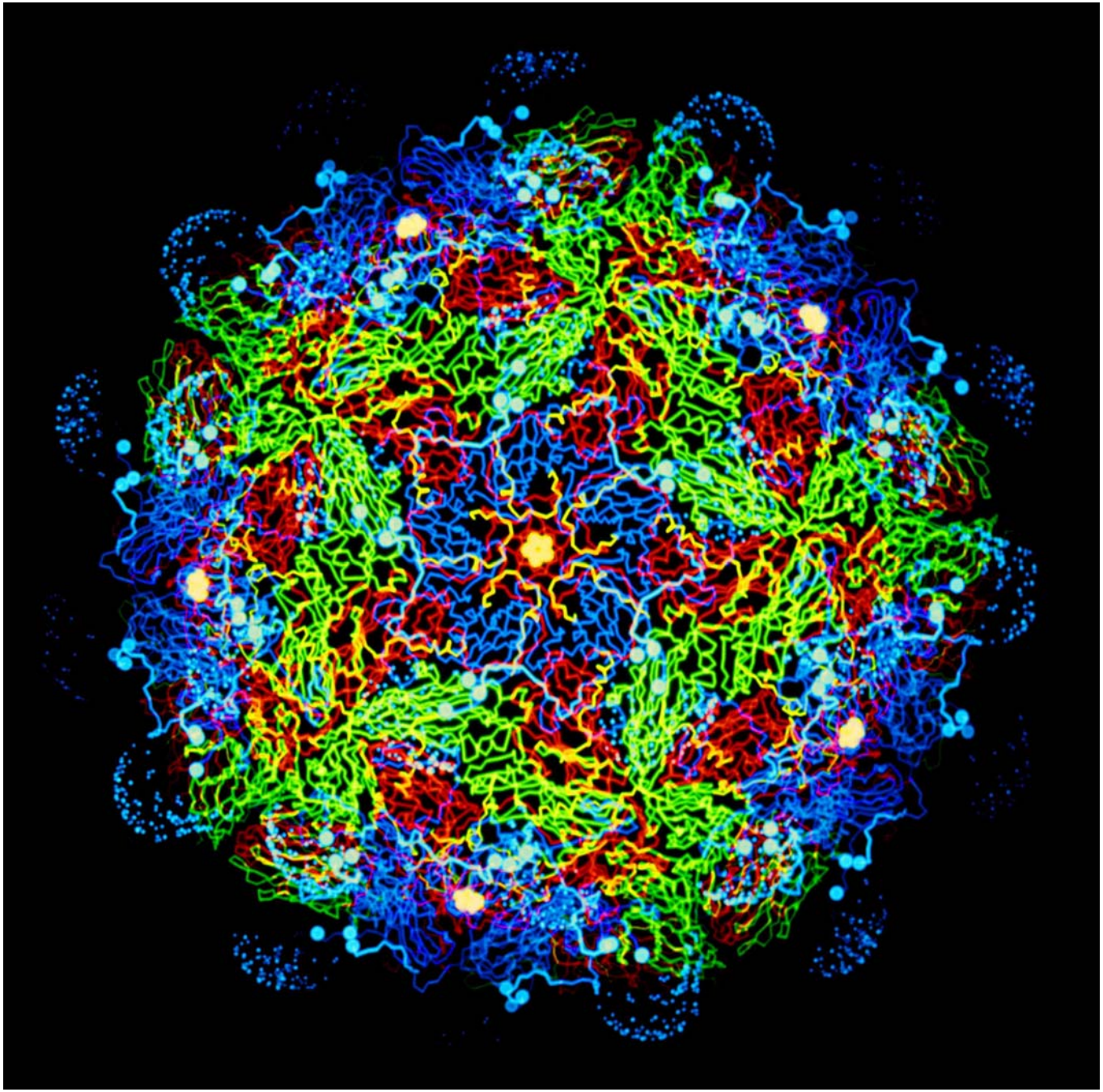
Bush Pig

Tick

Domestic Pig

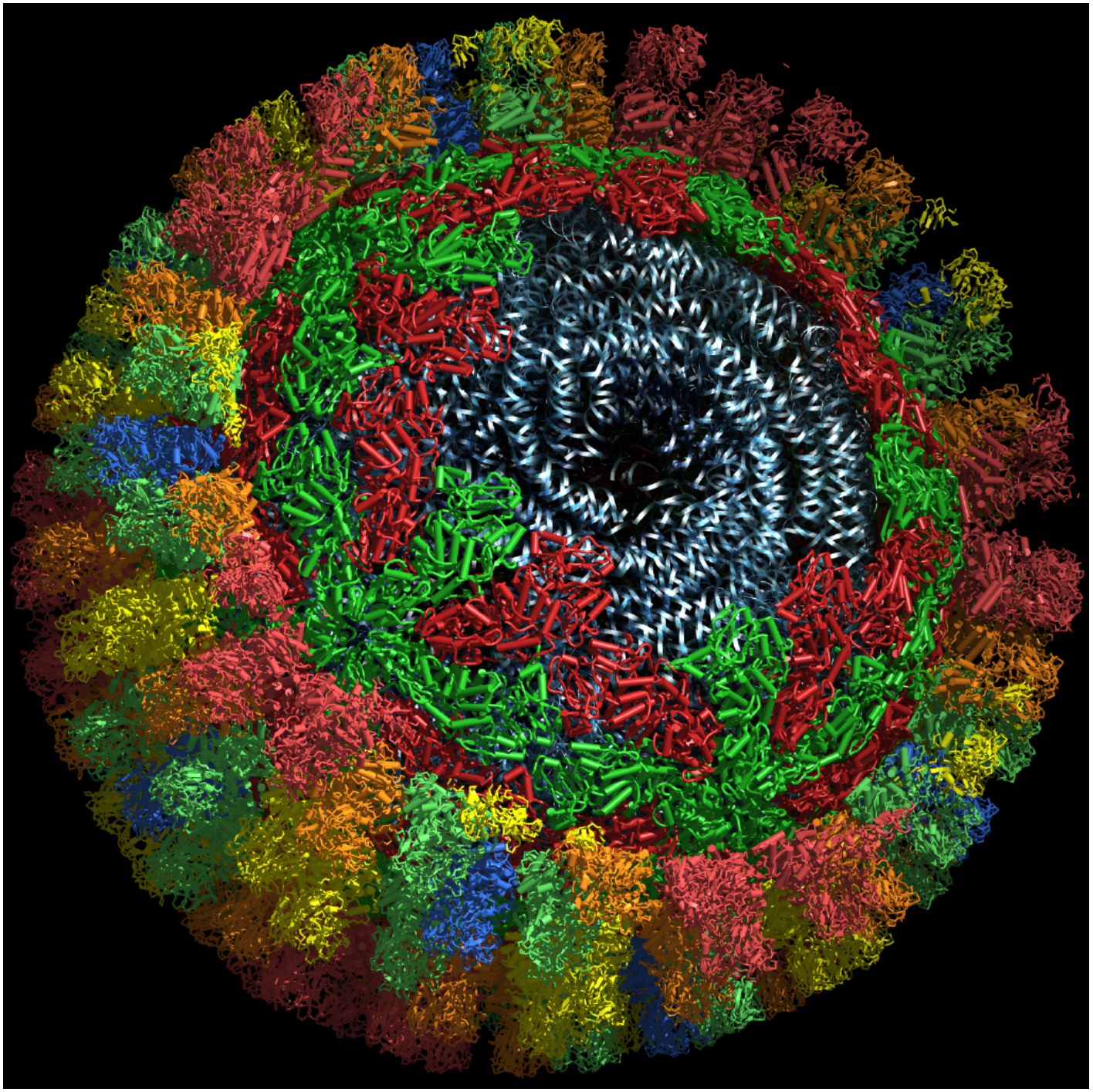


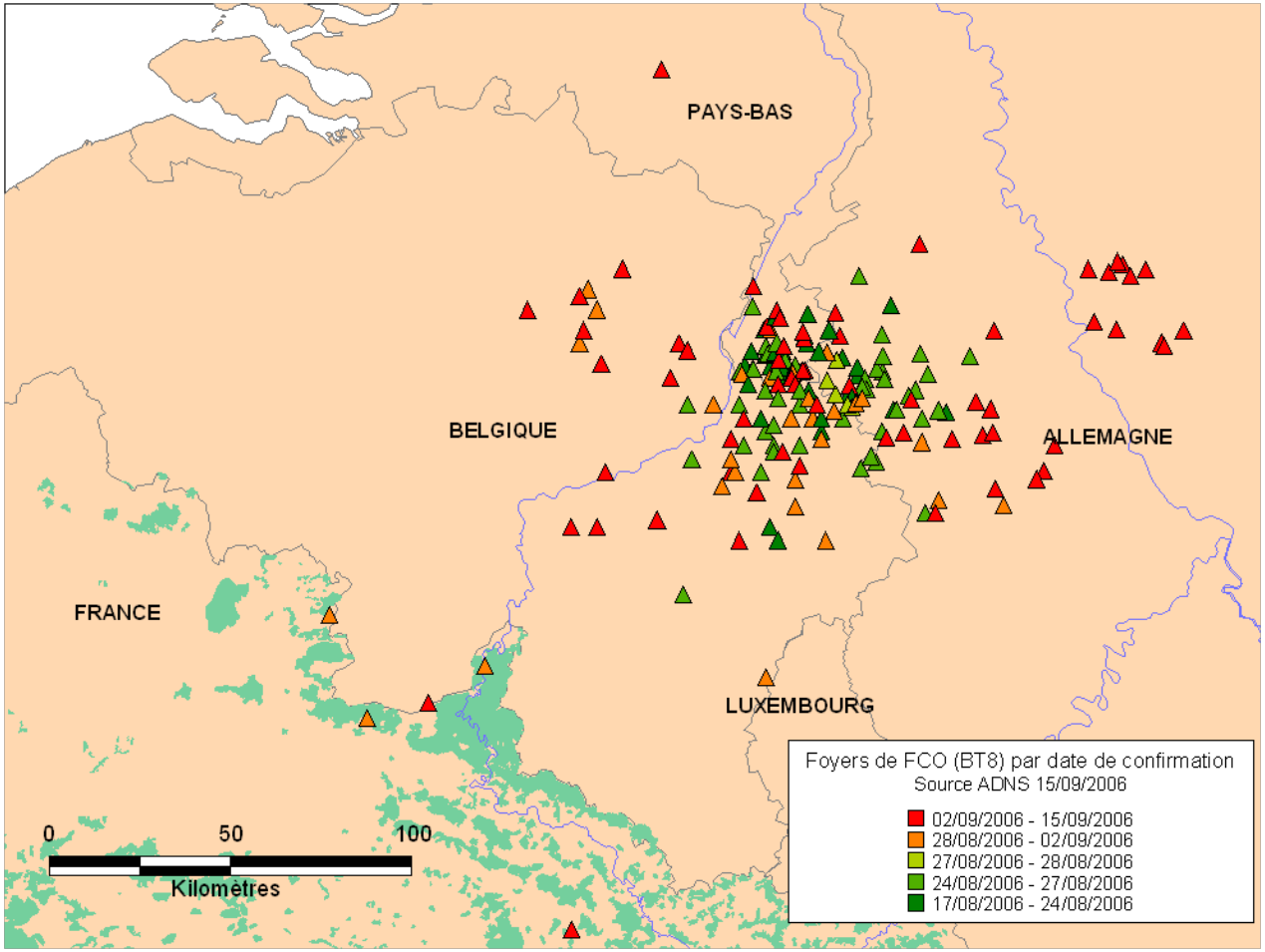
Le gouvernement malaisien fait abattre des porcs par milliers pour lutter contre l'épidémie. *Photo EPA.*



VACCINATION AGAINST FOOT-AND-MOUTH DISEASE

- SEVEN SEROTYPES FURTHER DIVIDED INTO NUMEROUS SUB-TYPES
- A PURIFIED VACCINE
- A COMPANION DIAGNOSTIC TEST BASED ON ANTIBODY DETECTION AGAINST NON-STRUCTURAL PROTEINS
- CERTIFICATION AT HERD LEVEL
- DETECTION OF CARRIERS?




PAYS-BAS
BELGIQUE
ALLEMAGNE
FRANCE
LUXEMBOURG
0
50
100
Kilomètres
Foyers de FCO (BT8) par date de confirmation
Source ADNS 15/09/2006
02/09/2006 - 15/09/2006
28/08/2006 - 02/09/2006
27/08/2006 - 28/08/2006
24/08/2006 - 27/08/2006
17/08/2006 - 24/08/2006

Clinical bluetongue in cattle: face

- Muzzle: ulcerous and necrotic lesions, scabs
- Nose: ulcers in the nostrils, mucous to mucopurulent nasal discharge
- Oral cavity: ulcers in the gengiva and the tongue, with hypersalivation
- Peri-ocular oedema and erythema, lacrymation
- Submandibular swelling

BLUETONGUE

- TWENTY-FOUR SEROTYPES
- TRANSMISSION BY BITING MIDGES (*Culicoides*)
- THE BEST WAY TO CONTROL IT, IS VACCINATION OF LIVESTOCK
- ATTENUATED OR INACTIVATED VACCINES
- TWO YEARS WERE NEEDED FOR THE AVAILABILITY OF AN INACTIVATED VACCINE AGAINST SEROTYPE 8

WEST NILE VIRUS INFECTION IN UNITED-STATES OF AMERICA AND CANADA

- BIRDS AS WILDLIFE RESERVOIR
- TRANSMITTED BY MOSQUITOES
- INFECTING HUMANS AND HORSES
- INCREDIBLY RAPID SPREAD
- VACCINES QUICKLY AVAILABLE FOR HORSES, INCLUDING A DNA VACCINE

RIFT VALLEY FEVER

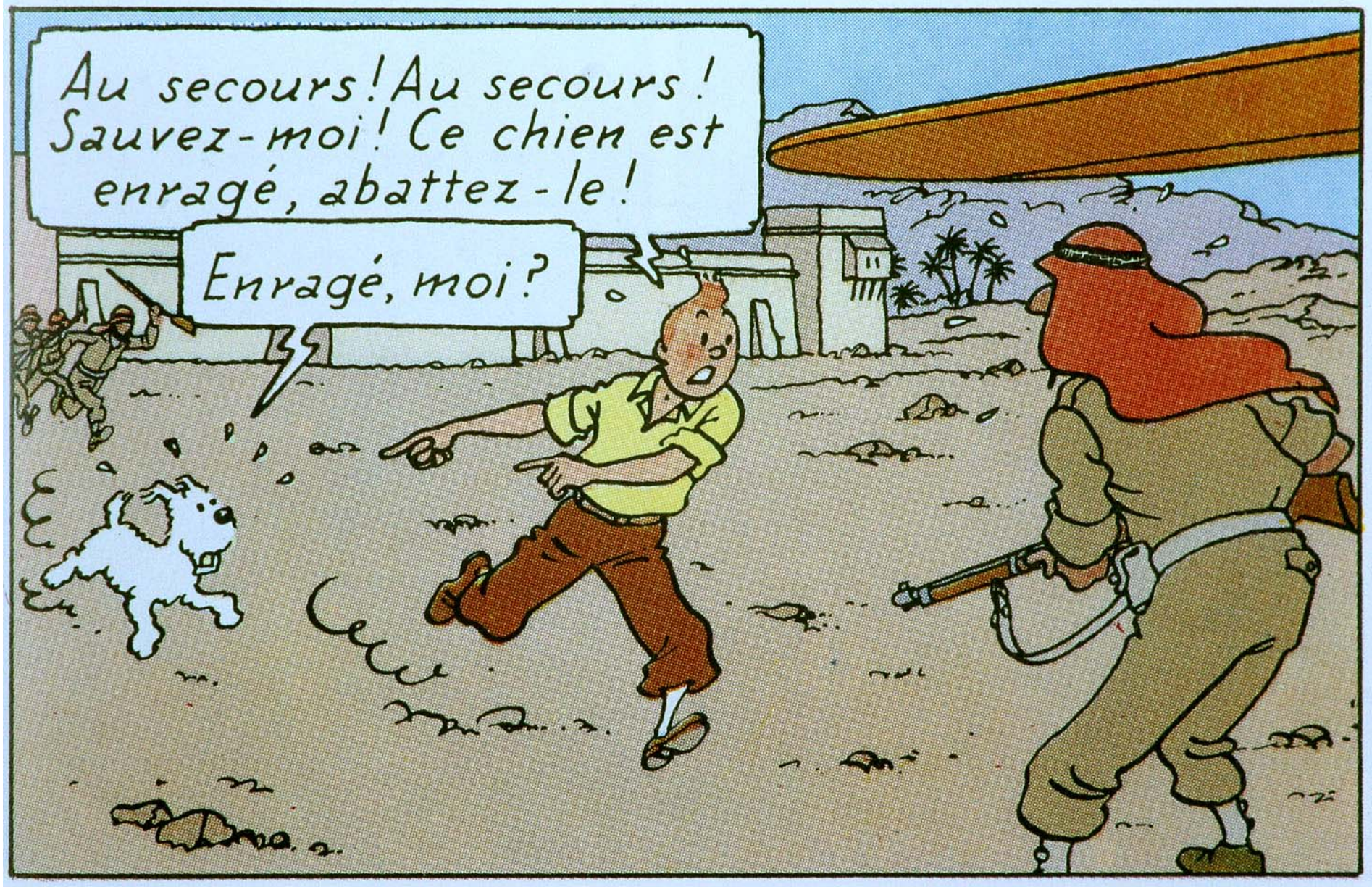
- EXPANDING ITS RANGE IN AFRICA
- RECENT INTRODUCTION IN MADAGASCAR
- TRANSMITTED BY MOSQUITOES
- INFECTING LIVESTOCK, WILD ANIMALS AND HUMANS
- AN ATTENUATED VACCINE AVAILABLE FOR SHEEP
- THIS VACCINE IS ABORTIGENIC

STOCKPILING

- STOCKPILING OF CONCENTRATED PURIFIED ANTIGENS OF FOOT-AND-MOUTH DISEASE VIRUS
- STOCKPILING TO MITIGATE THE RISK OF BIO-AGRO-TERRORISM
- STOCKPILING OF H5N1 INFLUENZA VACCINES FOR HUMANS ?

HIGHLY PATHOGENIC AVIAN INFLUENZA

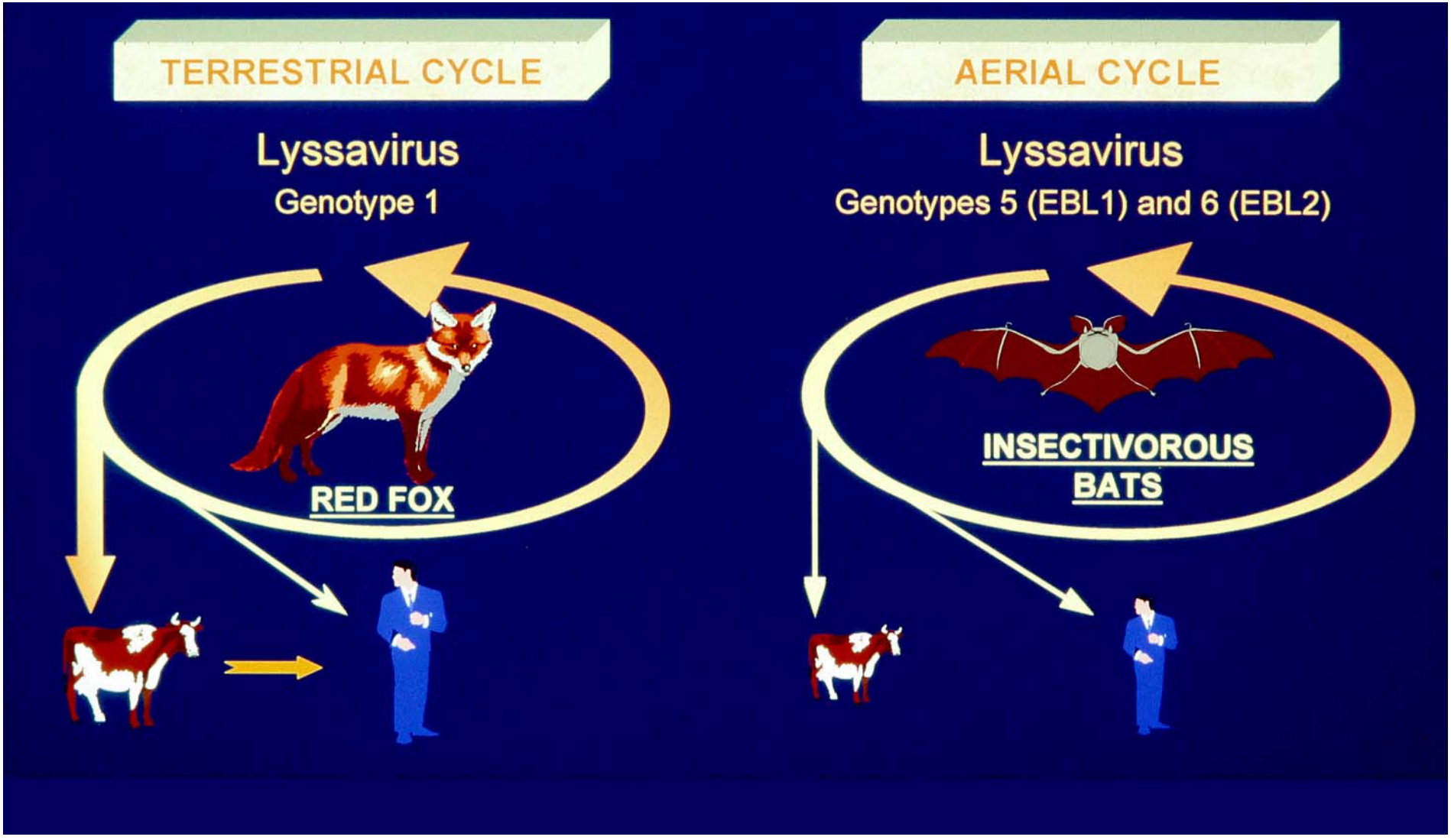
FOR THE TIME BEING THE BEST IS TO TRY TO CONTROL THE INFECTION AT THE AVIAN SOURCE, NOTABLY THROUGH VACCINATION,IN ORDER TO MINIMIZE THE RISK OF MUTATION, THE RISK OF TRANSMISSION TO HUMANS, AND AVOID A PANDEMIC

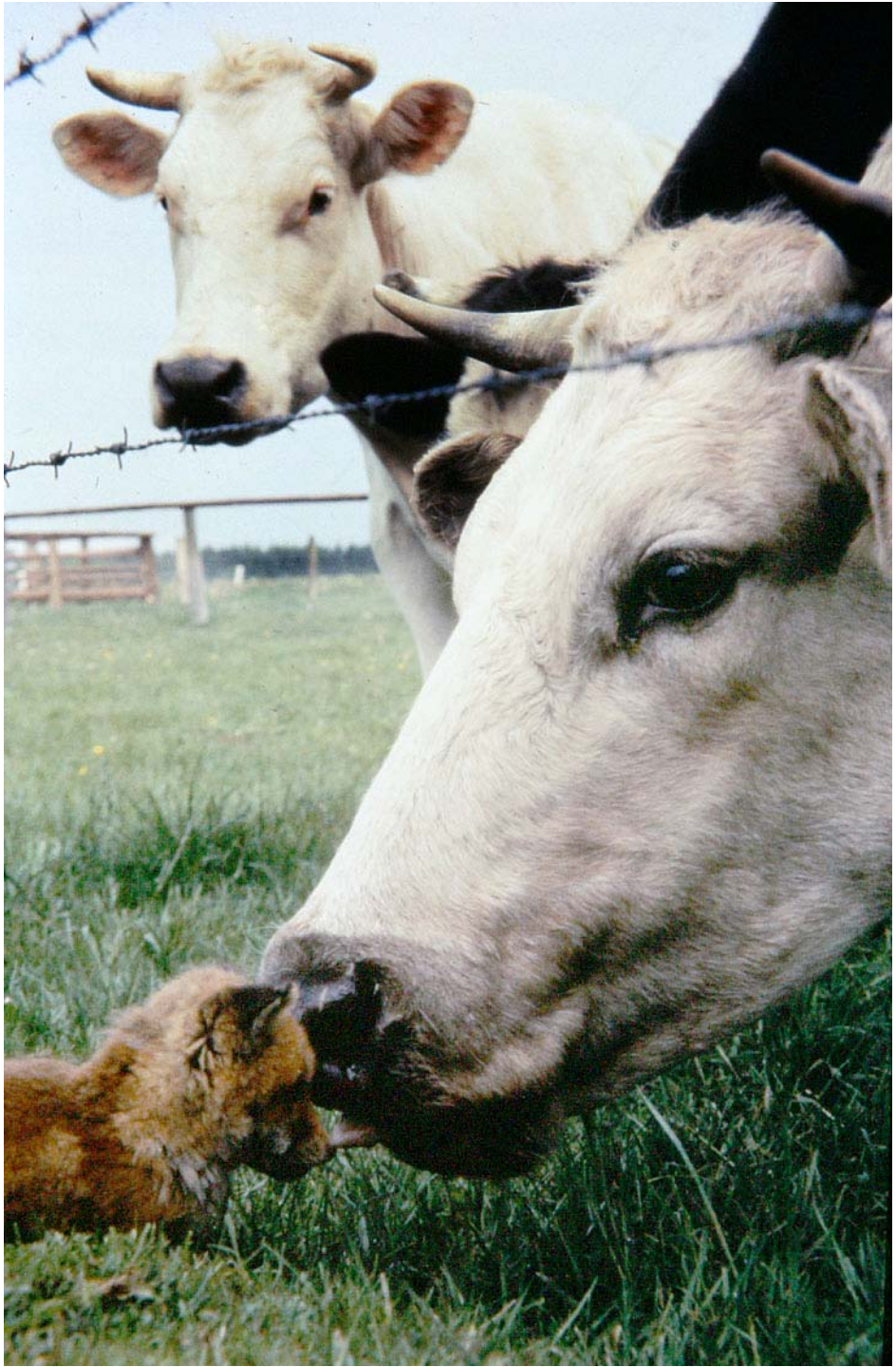

Au secours ! Au secours ! Sauvez-moi ! Ce chien est enragé, abattez-le !
Enragé, moi ?

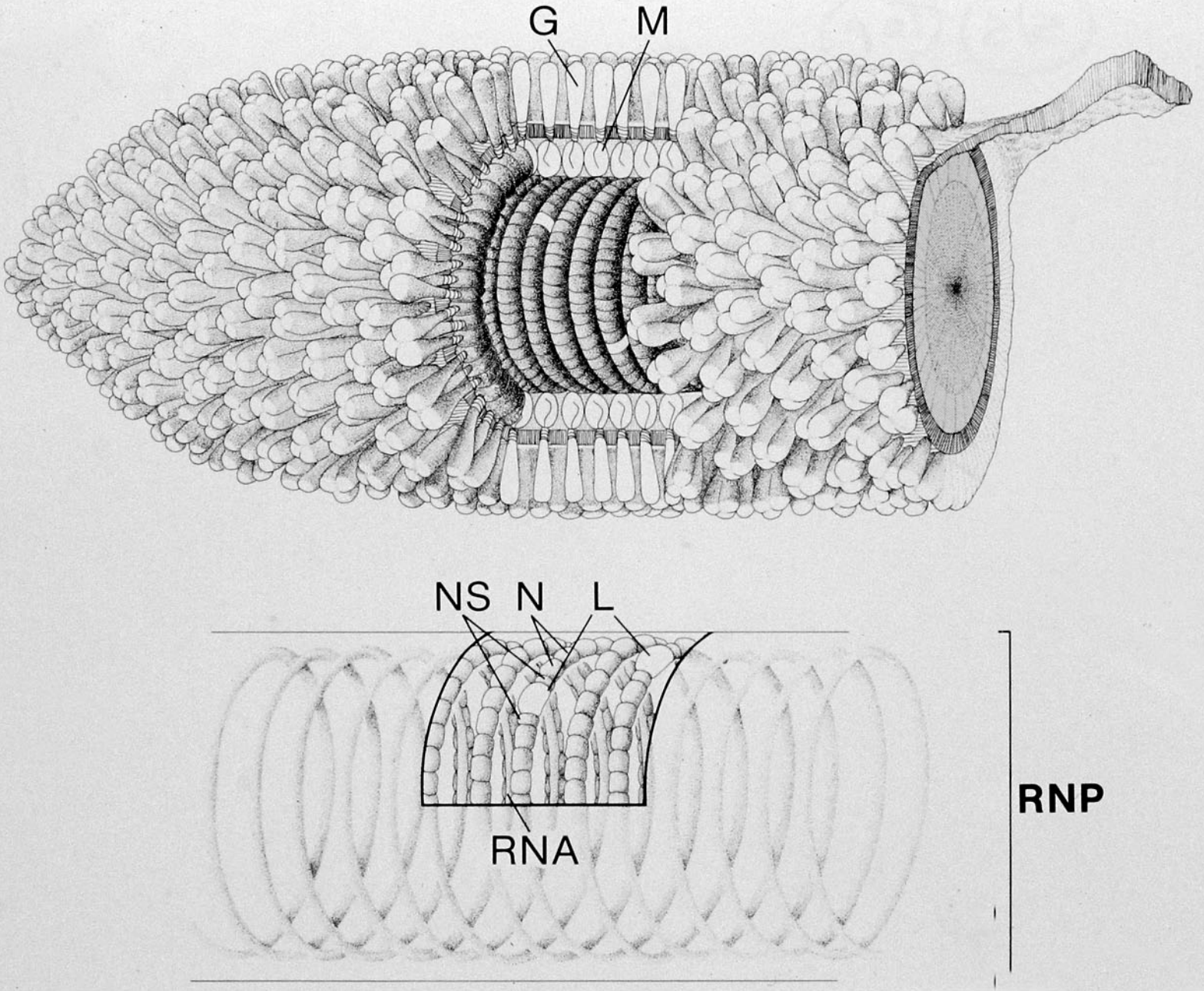
WILDLIFE VACCINATION AGAINST RABIES

WILDLIFE VACCINATION AGAINST RABIES IS A GOOD EXAMPLE OF CONTROL AT THE SOURCE.

EPIDEMIOLOGY OF SYLVATIC RABIES IN EUROPE



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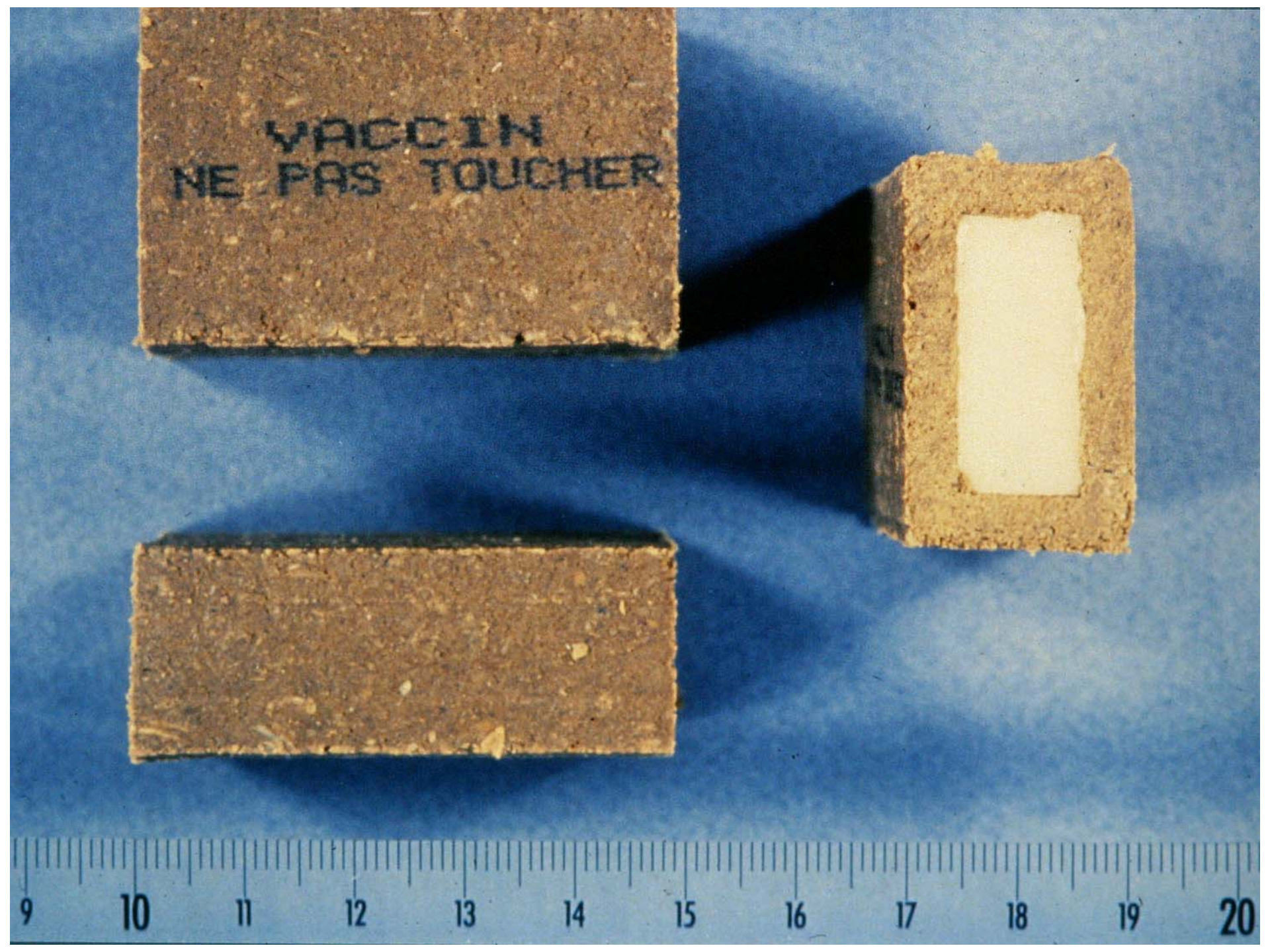
VACCIN
NE PAS TOUCHER
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NE PAS TOUCHER
VACCIN
MARS 1991

CONTROL OF FOOD POISONING

- PREVENTION OF ANIMAL CARCASS CONTAMINATION BY VACCINATION AGAINST *SALMONELLA* INFECTION
- VACCINATION OF CATTLE AGAINST *Escherichia coli* 0157:H7 IN USA
- PREVENTION OF CYSTICERCOSIS IN CATTLE AND PIGS

THE NEW CHALLENGES TO FACE

- Vaccination against new and emerging diseases
- Bio-and-Agro-terrorism
- Adaptation to ever changing pathogens
- Consumer's attitude towards animal vaccination
- Globalisation of trade (the 5ts and transboundary diseases)
- Harmonisation of international regulations
- Vaccination and animal diseases eradication
- Animal vaccination and public health